A NEW SPECIES OF GEKKONID LIZARD, GENUS *DIPLODACTYLUS* GRAY, FROM EASTERN AUSTRALIA.

By Arnold G. Kluge, Department of Biology, University of Southern California.
(*Communicated by Mr. H. G. Cogger.*)

(Plate xiv; one Text-figure.)

[Read 28th August, 1963.]

Synopsis.

A new species of the *strophurus* complex of the gekkonid lizard genus *Diplodactylus* Gray is described. The new species is known from northern New South Wales and Queensland. The possible relationships of the new species to *ciliaris* and *intermedius* are discussed.

The systematics of the *strophurus* complex of the genus *Diplodactylus* has been a major source of confusion to herpetologists (Zietz, 1920; Loveridge, 1934; Brazenor, 1951; Glauert, 1952; Mitchell, 1955). The complex, as currently defined, is comprised of *strophurus* Duméril and Bibron (1836), *spinigerus* Gray (1842), *ciliaris* Boulenger (1885), *intermedius* Ogilby (1892) and *aberrans* Glauert (1952). Although the group forms a well circumscribed and apparently natural complex within the genus, the majority of the obvious external morphological characters typical of its species (i.e., supraciliary spines, dorsal body tubercles and tail spination) exhibit considerable random and clinal variation. In an attempt to delimit the external morphological variation of the populations in the complex, all of the specimens located in Australian museum and university depositories were examined and it appears that the following additional undescribed species should be recognized.

Diplodactylus williamsi, sp. nov.

Holotype: A.M. R14987—Warrumbungle Mountains, New South Wales, Australia, collected by Harold G. Cogger. *Paratypes*: New South Wales: Ballimore, via Dubbo (A.K. 1414); Boggabri (A.M. R2007–9, A.M. R4775a-b); Garah (A.M. R12341); Macquarie Marshes (A.K. 1415); Mungindi (Q.M. J2324); Tamworth (A.M. R2624–5, A.M. R2628–31, A.M. R2633–4); Warialda (Q.M. J270); Warrumbungle Mountains (A.M. R14986). Queensland: Blackall (A.M. unlabelled); Darling Downs region (Q.M. J2324); Mount Isa (A.M. R15138); Murilla Station, near Dalby (Q.M. J8430–1); Retro Station, near Capella (A.K. 1175–9, A.K. 1208–12, Q.M. J6136, Q.M. J6139, A.M. R12109a-b); Townsville (A.M. R15128); Woodstock, near Townsville (A.M. R15645, A.K. 1416).

Referred Material: The following specimens are without accurate locality data and are therefore not included as paratypes: A.M. A265, A.M. R2184–5, A.M. R2785, A.M. R2787–9, M.M. R815, Q.M. J731.

Diagnosis: *Diplodactylus williamsi* differs from all other members of the genus in the following combination of characters: size large (snout-vent length 44·0 to 64·8 mm., av. 55·8); short, greatly depressed and laterally expanded digits; large subapical plates and transverse distal subdigital lamellae; an angular series of two to four fleshy cloacal spurs; preanal pores present; supraciliary spines projecting slightly beyond margin of eyelid (Pl. xiv, *a*); dorsal surface of body with two nearly parallel longitudinal rows of yellowish-orange sharply pointed tubercles and lateral to these a shorter row (posterior one-fourth to one-half of body) of tubercles of similar shape and colour (Pl. xiv, *b* and *c*); dorsal surface of tail covered with four parallel longitudinal rows of yellowish-orange spines (Pl. xiv, *d* and *e*); general colour and pattern grey (brown in preservative) with darker reticulations and spotting.

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Description of Species: Head moderately convex; eye large; snout long; rostral quadrangular, slightly less to slightly more than twice as wide as high; dorsomedian rostral crease variable (see discussion on intraspecific variation); nostril large, surrounded by first supralabial, rostral, two to three, av. 2·1, swollen supranasals, and one to three, av. 1·8, small postnasals; zero to four, av. 1·9, internasals separating greatly enlarged anterior supranasals; nine to twelve, av. 10·5, scales between postnasals and preocular granules; seven to eleven, av. 8·7, supralabials; nineteen to twenty-six, av. 21·8, scales between centrolateral margins of orbits (excluding those of dorsal eyelid); one to five, av. 2·5, very short spinose scales on posterior border of dorsal eyelid (only slightly projecting beyond margin of eyelid—Pl. xiv, *a*); mental small, nearly triangular, slightly wider than long to slightly longer than wide; ten to fourteen, av. 12·1, infralabials; scales bordering mental and infralabials slightly enlarged and flattened, gradually grading into granules of throat region; external ear opening moderately small, variable in shape and position with respect to angle of jaw (apparently due to different methods of preservation); scalation of dorsal surface of body heterogeneous (Pl. xiv, *b* and *c*), consisting of (1) sharply pointed tubercles in four nearly parallel rows (inner or primary pair begin above pectoral region and are continuous with spination of tail, outer or secondary pair originate much behind pectoral region and may be represented by only one or two tubercles anterior to groin), (2) small conical scales, and (3) minute triangular granules; ventral surface of body covered with moderately small flat imbricate cycloid scales; dorsal surfaces of limbs covered with slightly elevated and imbricate or juxtaposed scales surrounded by minute triangular granules; ventral surfaces of limbs covered with small conical scales surrounded by minute triangular granules; digits short, wide, depressed; subapical plates very large, wider than proximal width of digit; claws short, strongly curved, not or but slightly extending beyond margin of claw sheath; fourth finger with five to nine, av. 6·9, subdigital lamellae (zero to two, av. 0·8, minute scales between subapical plates and first enlarged transverse lamella; three to six, av. 4·2, enlarged undivided transverse lamellae followed by zero to four, av. 1·9, smaller scales); fourth toe with five to nine, av. 7·4, subdigital lamellae (zero to two, av. 0·9, minute scales between subapical plates and first enlarged transverse lamella; three to five, av. 4·3, enlarged undivided transverse lamellae followed by one to four, av. 2·2, small scales); tail covered above with heterogeneous scalations (Pl. xiv, *d* and *e*) consisting of (1) small conical juxtaposed or imbricate scales, (2) minute, approximately triangular granules, and (3) four relatively continuous longitudinal parallel rows of spines of variable length (see discussion on intraspecific variation); ventral surface of tail covered with small flat imbricate scales surrounded by minute granules; single diagonal row of one to five, av. 2·4, cloacal scales per side (males—one to five, av. 2·5, much larger and more prominent than in females; females—one to three, av. 2·1); males with four to eight, av. 5·5, preanal pores per side, separated by one to five, av. 1·8, scales (females normally lack preanal pores; however, there is some suggestion of them in three females from Retro Station, near Capella, Queensland).

Snout-vent length 44·0 to 64·8 mm., av. 55·8; (the following measurements are expressed as percentages of the snout-vent length) length of tail 50·8 to 71·0, av. 62·3; length of head 23·3 to 29·9, av. 26·6; length of snout 9·8 to 11·6, av. 10·5; diameter of orbit 5·3 to 7·7, av. 6·6; distance from eye to ear 7·9 to 9·6, av. 8·7; width of head 17·7 to 20·3, av. 18·8; distance from axilla to groin 43·6 to 52·8, av. 48·1; length of fore limb 28·3 to 36·0, av. 33·1; length of fourth finger 5·5 to 7·7, av. 6·5; length of hind limb 37·9 to 44·4, av. 40·7; length of fourth toe 7·0 to 8·8, av. 7·7.

In life dorsal surfaces are dark grey covered with irregular black reticulation. Occipital region and area between primary longitudinal rows of tubercles with a darker ground colour and heavier concentration of black reticulation. Dorsal body tubercles and spines light orange. Ventral ground colour in life greyish-brown with a fine scattering of black spots (generally restricted to individual scales). In preservative dorsal ground colour becomes light grey or tan and reticulation becomes brown or is

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completely lost. After a short period in preservative the tubercles become yellow or white.

Intraspecific Variation: The most striking geographical trends in the external morphology of *williamsi* are those of shape and size of the caudal spines. At the southern extreme of the geographical range of the species the spines are long and relatively thin (Pl. xiv, *d*). In populations to the north there is a gradual change toward short and relatively stout spines (Pl. xiv, *e*). From the material examined there does not appear to be a definite geographical break in the expression of these characters and apparently they represent a simple continuous north-south cline.

In all of the specimens examined from Retro Station, Woodstock, Townsville and Mount Isa (northern part of the range of the species) the rostral shield is only partly divided by the dorsomedian rostral crease. In the rest of the range, with a single exception of a specimen from Boggabri, the rostral is completely divided by the dorsomedian rostral crease.

It appears that there is a trend in the amount of black reticulation present on the dorsal surface of the head and body. The specimens from the northern part of the species range show an increased amount of reticulation; however, as was previously pointed out in the colour description there are rather striking changes in colour and pattern upon preservation. To substantiate the presumed trend in reticulation a larger number of living specimens must be examined.

Discussion: The relationships of *williamsi* to other members of the *strophurus* complex are difficult to interpret solely on the basis of the external characters studied in this paper. The following ideas concerning the affinities of *williamsi* should therefore be considered tentative and a more accurate and complete interpretation must await a revision of the genus with an investigation of the osteological characters.

As inferred from the head, body and tail spination, *williamsi* appears to be more closely related to *D. ciliaris* and *D. intermedius* than to any of the other members of the genus. The very short spinose scales over the eyes (extremely long in *ciliaris*) are identical with those found in *intermedius*. The shape, size, colour and distribution of the dorsal body tubercles show similarities to both *ciliaris* and *intermedius*. The spination of the tail is more suggestive of *ciliaris* than *intermedius*. From a general survey of a large number of additional external morphological characters there is no indication that *williamsi* is more closely related to one species than to the other. The distributional patterns and possible intergradation in central Australia indicate that *ciliaris* and *intermedius* are very closely related and represent derivatives of a once more widely ranging ancestral population. It is possible that the *williamsi* population represents a relict in northern New South Wales and Queensland of the ancestral *ciliaris-intermedius* population. The separation of the *williamsi* ancestor and the western populations is impossible to date, but may have occurred in Pleistocene. A subsequent eastward expansion of the ancestral population probably has followed, with what is now recognized as *ciliaris* moving down into Queensland from the northern part of the Northern Territory and becoming sympatric with *williamsi*, while *intermedius* moved into south-eastern New South Wales and overlapped only the southernmost margin of the range of *williamsi* (see fig. 1).

The only specific locality of sympatry between *intermedius* and *williamsi* is Boggabri, New South Wales. The former species has been collected at Carinda, Quambone, Coonamble and Warren, all localities interdigitated with records for *williamsi*, and possibly suggest a narrow zone of sympatry between the two species. In the zone of sympatry and adjacent areas both species occupy what appears to be a relatively uniform and continuous habitat. All the available information indicates that both species occur under the bark of the *Callitris* pine, but with the possible exception of the Boggabri locality, the two forms actually have not been collected together. The Boggabri specimens of both *intermedius* and *williamsi* are from early collections and no habitat information accompanies them. If future collecting shortens the distance between the localities of the two species particular attention should be paid to habitat

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As was noted in the section on intraspecific variation, specimens of *williamsi* from the southern extreme of its range are much more different morphologically from

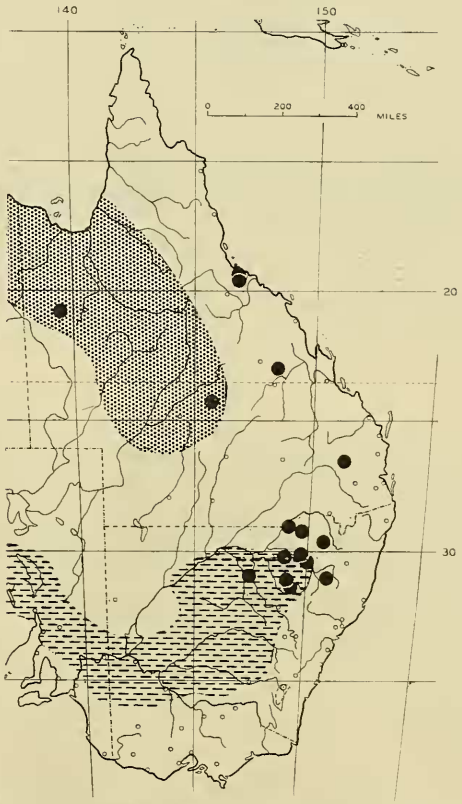

Figure 1. The distribution of *Diplodactylus williamsi* showing the individual localities (large solid black circles), and the approximate eastern extensions of the ranges of *D. ciliaris* (heavily stippled) and *D. intermedius* (horizontal dashes).

intermedius than are those farther to the north. In the narrow zone of sympatry with *intermedius* the differences appear to be of the greatest magnitude. The increase in morphological differentiation suggests the little understood phenomenon of character displacement (Brown and Wilson, 1956).

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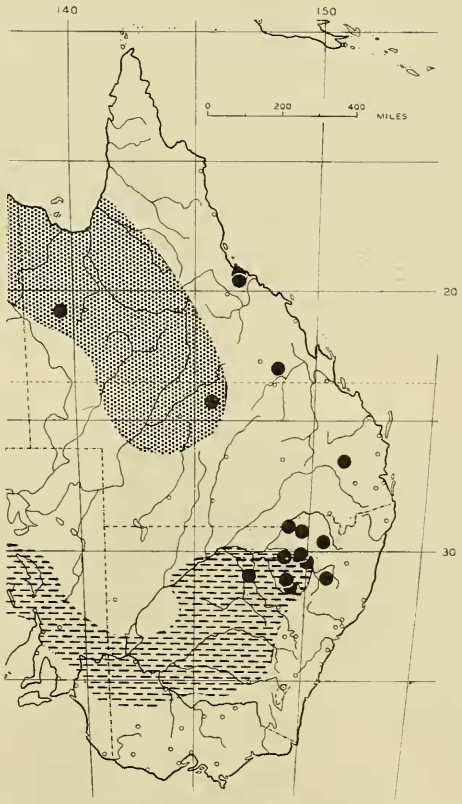

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EXPLANATION OF PLATE XIV.

a, Dorsal view of the head of *Diplodactylus williamsi* showing (arrow) the very short spinose scales on the posterior border of the dorsal eyelid. *b*, Dorsal view of *Diplodactylus williamsi* showing the heterogeneity of the scalation. *c*, Dorsal view of the body of *Diplodactylus williamsi* showing the continuous inner primary row of tubercles (solid arrow) and the shorter outer secondary row of tubercles (open arrow). *d*, Dorsal view of the tail of *Diplodactylus williamsi* showing the arrangement, shape and size of the spines (southern population). *e*, Dorsal view of the tail of *Diplodactylus williamsi* showing the arrangement, shape and size of the spines (northern population).

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EXPLANATION OF PLATE XIV.

a, Dorsal view of the head of *Diplodactylus williamsi* showing (arrow) the very short spinose scales on the posterior border of the dorsal eyelid. *b*, Dorsal view of *Diplodactylus williamsi* showing the heterogeneity of the scalation. *c*, Dorsal view of the body of *Diplodactylus williamsi* showing the continuous inner primary row of tubercles (solid arrow) and the shorter outer secondary row of tubercles (open arrow). *d*, Dorsal view of the tail of *Diplodactylus williamsi* showing the arrangement, shape and size of the spines (southern population). *e*, Dorsal view of the tail of *Diplodactylus williamsi* showing the arrangement, shape and size of the spines (northern population).